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VOLTAGE DIVIDERS
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AC PERFORMANCE OF THE MODEL DP-211 DEKAPOT®

The quoted accuracy and linearity of the DEKAPOT® is determined at dc. When ac is applied there will be additional errors superimposed due to the presence of small residual impedances in the circuit. An extensive study has shown that these residuals and the errors they produce are of such small magnitude as to be very nearly negligible throughout the frequency spectrum in which the DEKAPOT® will normally be used. The curves and equations that are presented here, are therefore intended to indicate the limits within which the DEKAPOT® should be used. In every case they are good approximations, but, it is not the manufacturer's intention that they should be considered as specifications or exact definitions of performance.

The actual equivalent circuit is very complex, including resistance, inductance and capacitance as both distributed and lumped constants. The first order approximation can be made on the assumption of a lumped capacitance between slider arm (terminal 2) and ground (normally terminal 1). Measurement indicates that the apparent magnitude of this capacitance is dependent in part upon both setting and frequency. Typical values range between 60 and 100 pf. Curves 2 and 3 on the accompanying sheet show the shape of linearity and phase shift with respect to dial setting. Since the shape of the curves is similar for different resistances and frequencies, it is convenient to define the effect of these quantities in terms of the maximum deviation that they produce. This occurs near mid-scale of the dial setting. The following empirical formulas give this maximum deviation:

$$\triangle\theta = -0.00009\, R_t\, F_o\, C_t \qquad \text{Phase Shift} \qquad (A)$$

$$\triangle e/E = -(0.875)\,(10^{-9})\, R_t^2\, F_o^2\, C_t^2 \qquad \text{Linearity Error} \qquad (B)$$

WHERE:

$\triangle\theta$ = Degrees shift of output with reference to input

$\triangle e/E$ = Output linearity error as a percentage of input

R_t = DEKAPOT® total resistance expressed as kilohms (1,000 ohms)

F_o = Frequency expressed in kilocycles

C_t = Slider loading capacitance expressed as micromicrofarads (total of DEKAPOT® and associated circuit)

These equations are valid for values of R_t and F_o, giving a product of not more than 10^3 kilohm-kilocycles. As an example of a calculation: -For a typical value C_t of 100 pf a 10 kilohm DEKAPOT® will have a phase shift of 9° lagging and linearity error of -0.875% at a frequency of 100 kilocycles.

Figure 1 gives measured phase shift and linearity to 100 kc of a typical 10,000 ohm DEKAPOT® with no external loading. Note that the ac linearity error is less than 0.01% and phase shift is below 1° to better than 10 kc!

AC PERFORMANCE OF MODEL DP-211 DEKAPOT® DECADE VOLTAGE DIVIDER

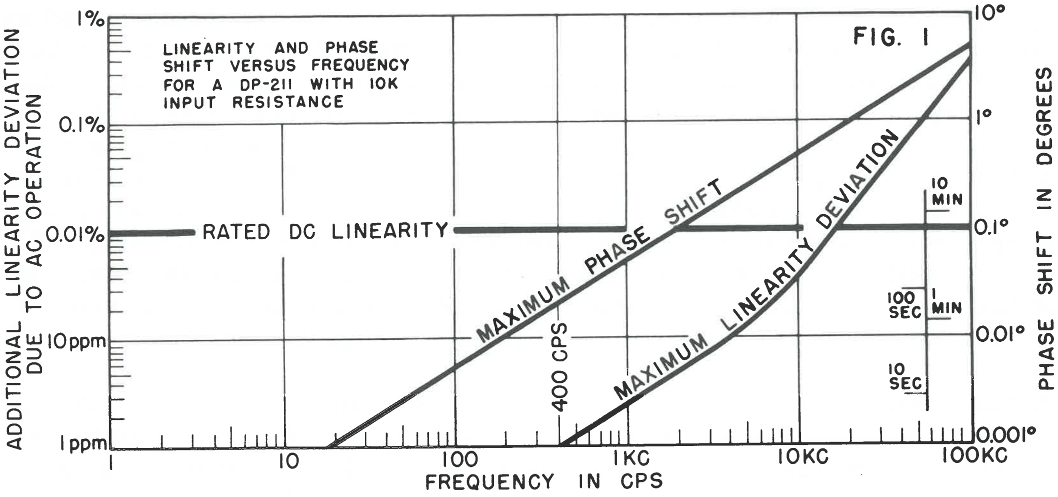

FIG. 1

The linearity and phase shift shown in the above curves are the maximum values near the mid-section of the Divider. In general the accuracies will be greater at both the high and low settings as illustrated by the curves below.

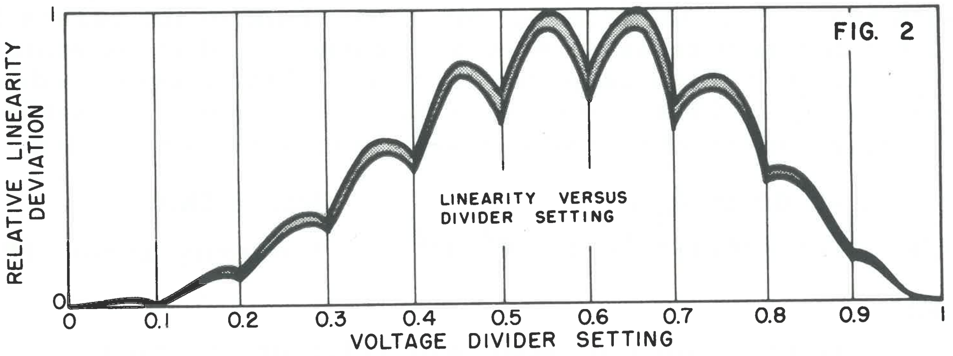

FIG. 2

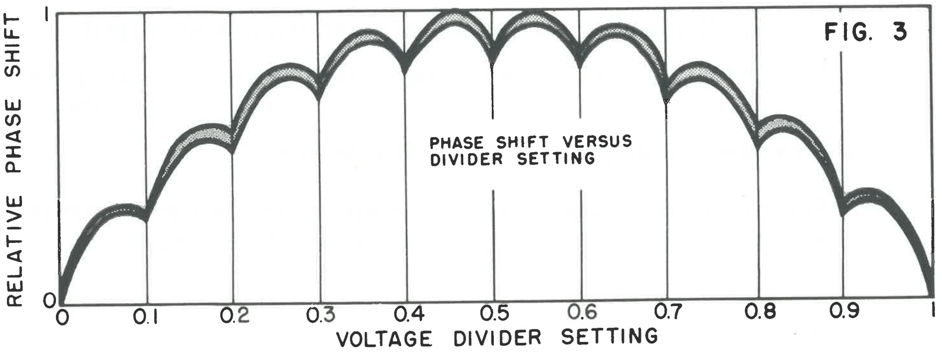

FIG. 3